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Action Plan Development:

1. **Stock Taking**
   - Existing policies and policy context;
   - Transformational, Tools, Technologies & Designs
   - Work force skills & capabilities;
   - Information, Knowledge and Awareness

2. **Scenario analysis & Goal setting**
   - **MRV Base-line & Mitigation Scenarios**
   - Market Data and Assumptions
   - Best-Practice Scenarios
   - Co-Benefits Analysis

3. **Implementation Road-Maps**
   - Key Milestones & strategic targets
   - Capacity Building, R&D, Demonstration
   - Monitoring, Evaluation & Reporting

4. **Fundraising**
   - **MRV Requirements**
   - NAMA, World Bank, Dev. Banks, GEF
   - Bi-lateral and Multi-lateral funds
The Common Carbon Metric (CCM)

• Measuring Energy Use & Reporting GHG Emissions from Building Operations
• CCM protocol and Excel based tool
• Developed by UNEP: SBCI
• Meets the requirements that reporting is measurable, reportable and verifiable (MRV)
• Phase 1 pilot: 2010-2011
• Phase 2 pilot: 2011-2012
• Energy: kWh/m²/yr
  kWh/occupant/yr
• Emissions (equivalent (e)): kgCO₂e/m²/yr
  kgCO₂e/occupant/yr
CCM methodology

- **Top-down approach**: Performance of the *whole* (regional, city or national level) is characterized at a coarse level using *estimated* data on fuel and electricity consumption.

- **Bottom-up approach**: Performance of individual case-study buildings is characterized at a fine level using *measured* data on fuel and electricity consumption.
  
  - Ideally sample size will be statistically valid, enabling verification of the *whole*.
Data Required: Top-down approach

- **Floor Area** of the Whole (stock) (m²).

- **Total occupancy** of the whole (number of occupants, or number of residents where information on occupancy is limited).

- Information on the % of the Whole’s **occupants** and **building area** attributable to different categories of building stocks (%).

- At a minimum for: residential and non-residential buildings. Information on the **total amount of electricity** consumed by the Whole and on the amounts of **different types of fuels** used.

- Information on the % of the Whole’s **electricity and fuel use** that is **attributable to different categories of building stocks** (%).

- **Custom emission factors** may optionally be provided in place of the **default emission factors** for electricity and fuel use.
Data Required: Bottom up approach

- **Descriptive information**, including **building name, building category**, year of construction and year of last major retrofit, and address.

- **Occupancy** (number of occupants) and **area** (m2).

- Data on the **total amount** of purchased and **metered electricity** (in kWh).

- Data on the **total amount of different fuels** consumed (various measurement units).

- Custom emission factors may optionally be provided in place of the default emission factors for electricity and fuel use.

- Users may optionally report the **amount of purchased green power** or the **amount of renewable energy that has been generated on-site and returned to the grid**.
Case Study: GHG Baseline Kuala Lumpur Affordable Housing

Electricity-Related GHG emissions, and its Affordability in Malaysian Low-Cost Housing

Case Study of Two Public PPR Low-Cost Housing Projects in Kuala Lumpur

Data Used:

Top-Down: Total floor area of building stock and total occupants derived from National Statistics and Previous Studies

Bottom Up: Electricity bills of 383 household units, and a survey questionnaire of 281 households

Source: Zaid, S. 2013 *Electricity related emissions and affordability in Malaysian low-cost housing*
## Results

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>Bottom-Up Approach</th>
<th>Top-Down Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy Consumption</td>
<td>GHG Emission</td>
</tr>
<tr>
<td></td>
<td>kWh/m²/yr</td>
<td>kgCO₂e./m²/yr</td>
</tr>
<tr>
<td></td>
<td>kWh/occupant/yr</td>
<td>kgCO₂e./occupant/yr</td>
</tr>
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<td>PPR Beringin</td>
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<td>531</td>
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<tr>
<td>PPR Intan Baiduri</td>
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<td>508</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>1,039</td>
</tr>
<tr>
<td>Average</td>
<td>43</td>
<td>519</td>
</tr>
</tbody>
</table>
CCM 2.0 Development

**New features:**
- Options for building policy scenarios
- Simpler methodology to 3CSEP-HEB
- Applicability to any country or city
- Modeling tool + data storage + LOD → growing coverage
- Data on existing policies
- Online vs offline mode

**CCM 2.0**

**3CSEP-HEB Model**

**Common Carbon Metric**

Floor Area Model
- Building types, vintages
- Performance-based approach
- Room for scenario analysis
- Default data & assumptions

Similar input data needs
- Simplicity of the methodology
- Emission factors
- Different levels of analysis
CCM 2.0: Coming Soon

ABOUT

Welcome to the Common Carbon Metric website for Energy Efficiency in Buildings

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COMMISSIONED BY

IMPLEMENTED BY
1. Basic Information

Name of your Assessment

Please, select the approach you would like to use for your assessment

- Top-down
- Bottom-up
- Hybrid

Would you like to conduct baseline or future-lines assessment?

- Baseline
- Futureline(s)

Select a baseline

Specify the start and end year of your futureline

2014 to 2020

Type the name of your futureline

futureline 1

Please, indicate the level you would like to make the assessment for

- Region
- Country
- City
- District
- Portfolio of Individual buildings

SAVE & NEXT
Scenarios (BAU, Mod, Deep) can be predefined or user-customised, opportunity to create a number of scenarios by varying certain assumptions.

The tool can be applicable to **any region, at different scales**, new regions can be added, regional comparison can be enabled, default data/assumptions from 3CSEP-HEB model can be used.

Estimations can be made for a certain year (**base year**) or a timeline can be set by the user up to 2050...

The tool will allow for calculating energy use and related CO2 emissions from **FIVE END USES**: SH, SC, WH, APP, LIGHTING.

The tool can benefit from a comprehensive **climate classification** of 3CSEP-HEB model, a user can create their own (17 climate zones).

The tool can use the **building vintage** typology of 3CSEP-HEB model: new, existing, retrofit, advanced.

The tool can use the **building types** classification of 3CSEP-HEB model: SF, MF, Commercial (offices... etc), Urban, Rural.
**Baseline** Development that is expected without initiating any additional action to reduce emissions. The baseline is also referred to as ‘business as usual’,

**Futureline** While the baseline aims to present the current state, the futureline aims to predict the future scenarios.
Data Inputs for Bottom-up approach: space heating, cooling & water heating

- **SPACE HEATING**
  - Floor area per capita (base year)
  - Commercial floor area (base year)
  - Population projections
  - GDP projections
  - Retrofit & demolition rates
  - Energy intensities for SH
  - Fuel mix for SH
  - Emission factors for each fuel types

- **SPACE COOLING**
  - Energy intensities for SC
  - Fuel mix for SC

- **WATER HEATING**
  - Energy intensities for WH
  - Fuel mix for WH
Inputs for Bottom-up lighting & appliances

Data is available in the en.lighten initiative

**LIGHTING**
- Installed stock of lamps (base year)
- Lamps wattage
- Average daily operating hours
- Average lamp lifetime

**APPLIANCES**
- Sales data in the start year
- Expected growth by the end year
- Unit energy consumption
- Average appliances lifetimes
- Fuel mix for appliances

Emission factors for each fuel types
Data Inputs for Top-down approach: space heating, cooling & water heating

- Energy consumption in the building sector in the country
- Share of the energy use in the total energy in the country
- Share of the energy use for SH
- Share of the energy use for SC
- Share of the energy use for WH
- Annual growth in energy use for SH
- Annual growth in energy use for SC
- Annual growth in energy use for WH
- Fuel mix for SH
- Fuel mix for SC
- Fuel mix for WH
- Emission factors for each fuel types
Inputs for Top-down lighting & appliances

**LIGHTING**

- Electricity use in buildings
- Share of electricity for lighting
- Share of electricity use for lighting by building type
- Lamps wattage
- Average daily operating hours
- Average lamp lifetime
- Emission factors for electricity

**APPLIANCES**

- Energy use in buildings
- Share of energy use for appliances
- Share of energy use for each appliance category
- Expected annual energy use growth rate
- Fuel mix for WH
- Emission factors for each fuel types

Data is available in the en.lighten initiative.
Further application of CCM

- CCM has helped to establish a system of MRV indicators for the follow-up of policy implementation and reporting on building-related GHG emissions,

- **Nationally Appropriate Mitigation Actions (NAMAs)** To facilitate NAMAs, a globally consistent MRV methodology is essential to measure and track energy use and energy reductions from buildings.

- **CCM is able to support the establishment of baselines from the sector or sub-sector** (residential, commercial, etc.), thus allowing measurement over time of increased efficiency and GHG reductions from a particular building stock. (UNEP DTIE project - NAMAs for the Building Sector in Asia)

- **ISO standard** CCM has informed the development of an ISO standard on carbon metric of buildings (ISO/TC59/SC17).
Thank you!

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